

**REMARKS**

Claims 17, 9, 10, and 15-22 are pending. Claims 8 and 11-14 are currently canceled. Claims 16 to 20 have been withdrawn from consideration. Claims 1, 21 and 22 are currently amended. The Applicants request that the Examiner enter the suggested amendments since they should put the case in condition for allowance. Reconsideration of the application is requested.

**§ 112 Rejections**

Claims 1-7, 9, 10, and 15 stand rejected under 35 USC § 112, first paragraph, as purportedly failing to comply with the written description requirement. It is the Examiner's position that the claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner states that claim 1 recites "dry grinding" which does not appear to be supported by the specification as filed. The Examiner furthermore states that the grinding takes place using  $\text{Li}(\text{OH})\cdot\text{H}_2\text{O}$ , which is a hydrate compound. The Examiner states that hydrates are compounds that contain water and that the specification does not explicitly state "dry" grinding and the disclosure leads one of skill to believe that the grinding takes place in the presence of water.

The Applicants have amended claim 1 to recite "grinding a dry precipitate of  $[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{OH}_2$  with a stoichiometric amount of  $\text{LiOH}\cdot\text{H}_2\text{O}$  or  $\text{Li}_2\text{CO}_3$  and at least one boron compound as sintering agent to form a resulting mixture". Support for this amendment can be found, for example, on page 7, lines 5-7 of the specification as filed. The Applicants respectfully traverse the Examiner's conclusion that the grinding takes place in the presence of water. One of skill in the art would know that a hydrate, such as  $\text{LiOH}\cdot\text{H}_2\text{O}$ , contains a stoichiometric amount of water tied up in its crystal structure. As such, unless the hydrate is heated, the water is a part of the solid crystal. Applicants also traverse the Examiner's argument that "the disclosure leads one of skill to believe the grinding takes place in the presence of water (hydrate compound or aqueous solution) for at least the following reason. The specification as filed indicates (page 6, lines 2-5) that the precipitated transition-metal hydroxide (TMOH) is "mixed by grinding" with a combined amount of  $\text{LiOH}\cdot\text{H}_2\text{O}$  and sintering agent. The specification further states that, after grinding, pellets were formed. There is no indication or suggestion from the specification that an

aqueous solution is involved in the mixing by grinding step. The Examples do not disclose an aqueous solution. Furthermore, there is no indication from the specification that any heating is involved in the “mixed by grinding” step. As indicated above, one of skill would know that, absent heating, the stoichiometric amount of water in the lithium hydroxide hydrate structure would remain in the crystal. For at least these reasons which include the amendment of claim 1 the Applicants have overcome the Examiner’s rejection of Claim 1 under 35 USC § 112, first paragraph. Claims 2-7, 9, 10, and 15 depend upon amended claim 1 and add further limitations thereto. Since amended claim 1 overcomes the rejection, likewise so do claims 2-7, 9, 10, and 15.

In summary, Applicants submit that the rejection of claims 2-7, 9, 10, and 15 under 35 USC § 112, first paragraph, have been overcome, and that the rejection should be withdrawn.

### **§ 102/103 Rejections**

Claims 1-3, 5-7, 9, 10, and 15 stand rejected under 35 USC § 102(b)/103(a) as purportedly being anticipated by, and alternatively unpatentable over, Shiozaki et al, JP 2002-304993. It is the Examiner’s position that Shiozaki teaches a positive electrode active material for a secondary battery having the formula  $\text{Li}_x\text{Mn}_a\text{Ni}_b\text{Co}_c\text{O}_2$  with a, b, and c represented by the Figure shown in the abstract. The Examiner also asserts that Table 1 teaches a specific compound of  $\text{LiMn}_{0.35}\text{Ni}_{0.42}\text{Co}_{0.23}\text{O}_2$  among other specific compounds. The Examiner states that a transition metal hydroxide may be used as a raw material or a precursor and that a boron compound is added to the mixture before heat treatment to effect sintering. The Examiner further states that the boron compound may be boric acid or boron oxide in stated amounts. A lithium compound such as lithium hydroxide or lithium carbonate is added to the mixture, the mixture is heat treated at a temperature between 950-1100°C and that the mixture is heat treated in an oxygen atmosphere for 5 hours. Thus the claims are anticipated. The Examiner also states that the pellet density of claim 1 and the properties recited by claim 9 and 10 of the produced Li-Ni-Co-Mn-oxide compound are considered inherent in view of the teachings of Shiozaki. Since the method of the claimed invention and the methods of the prior art appear to be the same, one of skill would have known that the similar materials produced by similar methods would have similar properties.

With respect to the rejection under 102(b), the Applicants respectfully traverse for at least the following reasons. The Figure in the abstract of Shiozaki, upon careful inspection, excludes the line where the amount of Mn and Ni are the same. This is supported by the statement in the abstract, "...a, b and c should be positioned in a range shown by a region surrounded by lines". (emphasis added) Furthermore, the region is bounded by points that are open circles which indicate, to one of skill in the art, that the bounding lines are excluded from the bounded region. The specific compound,  $\text{LiMn}_{0.35}\text{Ni}_{0.42}\text{Co}_{0.23}\text{O}_2$ , listed by the Examiner does not have  $\text{Mn}=\text{Ni}$  as required by Applicants' amended claim 1. Example 8 ( $\text{LiMn}_{0.3}\text{Ni}_{0.3}\text{Co}_{0.4}\text{O}_2$ ) is purportedly an Example of the invention but does not conform to the exclusion of the line where  $\text{Mn}=\text{Ni}$  as explained in the abstract and illustrated in the Figure of Shiozaki. The Applicants contend that this is likely a comparative example of the boundary of the region bounded by points. Nevertheless, with respect to Example 8, the Examiner has not shown that Shiozaki teaches or discloses (via Example 1, 8, or other specific compounds) a method that comprises grinding a dry precipitate of  $[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{OH}_2$  with a stoichiometric amount of  $\text{LiOH}\cdot\text{H}_2\text{O}$  or  $\text{Li}_2\text{CO}_3$  and at least one boron compound as sintering agent to form a resulting mixture where  $0.1 \leq x \leq 0.375$ . Example 8 is the only example of a mixed metal oxide where  $\text{Ni}=\text{Mn}$ . However, the Examiner has not shown where Example 8 has a sintering agent. Examination of [0076] of Shiozaki does not reveal a sintering agent as required by Applicants' amended claim 1. Furthermore, all of the Examples and teachings in Shiozaki use a "wet slurry" method. For at least this reason, the Examiner's rejection of claim 1 under 102(b) over Shiozaki is unwarranted and should be withdrawn.

With respect to the 103(a) rejection, the Examiner has not shown that Shiozaki teaches or suggests grinding a dry precipitate of  $[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{OH}_2$  with a stoichiometric amount of  $\text{LiOH}\cdot\text{H}_2\text{O}$  or  $\text{Li}_2\text{CO}_3$  and at least one boron compound as sintering agent to form a resulting mixture where  $0.1 \leq x \leq 0.375$ . Furthermore, Shiozaki does not teach or suggest heating the mixture until the lithium mixed metal oxide has a pellet density of from about 3.3 to about  $3.5 \text{ g/cm}^3$  as recited in Applicants' claim 1. One of skill in the art of lithium batteries and cathode materials useful in those batteries would know that the chemistry of lithium ion cathode materials is a very unpredictable art. As such the Applicants have demonstrated that using the method recited in amended claim 1 on the materials recited in claim 1 (where  $\text{Mn}=\text{Ni}$ , for

example), cathode materials with high pellet densities can be obtained. The Examiner has not shown that Shiozaki teaches or suggests such a method that will produce Applicants claimed compounds with the stated pellet densities. As such, the Examiner has not made a *prima facie* case of obviousness and the rejection under 103(a) is unwarranted and should be withdrawn. Claims 2-7, 9, 10, and 15 depend upon amended claim 1 and add further limitations thereto. Since amended claim 1 overcomes the rejection, likewise so do claims 2-7, 9, 10, and 15.

In summary, Applicants submit that the rejection of claims 2-7, 9, 10, and 15 under 35 USC § 102(b)/103(a) as purportedly being anticipated by, and alternatively unpatentable over, Shiozaki et al, JP 2002-304993 is overcome.

### **§ 103 Rejections**

Claims 21 and 22 stand rejected under 35 U.S.C. 103(a) as purportedly being unpatentable over, Kang et al., US 7,205,072 B2. The Examiner has asserted that Kang teaches a cathode material for a lithium ion rechargeable battery that has the formula  $\text{Li}_{1+x}\text{Ni}_\alpha\text{Mn}_\beta\text{Co}_\gamma\text{M}'_\delta\text{O}_{2-z}\text{F}_z$  wherein x is between about 0 and 0.3,  $\alpha$  is between about 0.2 and 0.6,  $\beta$  is between about 0.2 and 0.6,  $\gamma$  is between about 0 and 0.3,  $\delta$  is between about 0 and 0.15, and z is between about 0 and 0.2. The Examiner further asserts that to prepare the  $\text{Li}_{1+x}\text{Ni}_\alpha\text{Mn}_\beta\text{Co}_\gamma\text{M}'_\delta\text{O}_{2-z}\text{F}_z$  compound, appropriate amounts of lithium hydroxide (or lithium carbonate), lithium fluoride and Ni-Mn-Co-hydroxide are mixed. The mixture is calcined at 450-550°C for 12-30 hours in air and then at 900-1000°C for 10-24 hours in either air or oxygen. The Examiner asserts that claims 21 and 22 recite properties of the produced Li-Ni-Co-Mn-oxide compound, which are considered inherent in view of the teachings of Kang. The Examiner admits that Kang does not explicitly state the amount of sintering agent added to the mixture to prepare the cathode active material.

The Applicants have amended claims 21 and 22 to recite that  $0.025 \leq x \leq 0.25$ . Support for this amendment can be found, for example, in Tables 1 and 2. The Applicants respectfully assert that amended claims 21 and 22 are patentable. The Examiner has not shown that Kang teaches or suggests a method of producing  $\text{Li}_y[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$  wherein  $0.025 \leq x \leq 0.25$ , and  $0.9 \leq y \leq 1.3$ , the method comprising mixing  $[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{OH}_2$  with LiOH or  $\text{Li}_2\text{CO}_3$  and at

least one alkali metal fluoride to form a resulting mixture and heating the resulting mixture until a composition of  $\text{Li}_y[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$  having a pellet density from about  $3.3 \text{ g/cm}^3$  to about  $4.0 \text{ g/cm}^3$  is obtained for use in a lithium-ion battery, wherein the total amount of alkali fluorides is greater than 0.2% and up to about 10% of the total weight of the mixture. The Examiner states that Figure 4 teaches and suggests varying the amount of LiF in the mixture to produce various compound oxide cathode active materials and that one of skill in the art would know what an appropriate amount of lithium fluoride would be to be added to the mixture to get desired compound oxide products. The Applicants respectfully traverse this argument for at least the following reason. Kang does not teach what an appropriate amount of lithium fluoride is that may be added to the mixture to make Applicants' claimed materials. With respect to Figure 4, there are no compounds in Figure 4 that have  $\text{Ni}=\text{Mn}$  as required by Applicants' amended claims 21 and 22. It is well known that chemistry, especially the chemistry of lithium metal oxide electrode materials, is an unpredictable art. It is improper for the Examiner to suggest that an appropriate amount of sintering agent for one group of lithium metal oxides, such as those disclosed in Figure 4 of Kang, would be appropriate for materials of the Applicants' claims 21 and 22. Furthermore, the Applicants' specification as filed (see page 12, lines 4-18) suggests that more LiF ("at and above 3 wt% addition of LiF" for  $x=0.1$ ) with another 3 hours of treatment gave even higher pellet densities. There is a relationship between  $x$ , the amount of LiF added, and the amount of sintering time disclosed by the Applicant. Thus, it would take more than routine experimentation for one of skill in the art to determine "an appropriate amount of sintering agent". For at least these reasons, the Examiner has not made a *prima facie* case of obviousness and the Applicants request that the rejection be withdrawn. Finally, the Applicants would like to point out that all of the materials in Figures 4-17 of Kang do not meet the requirements of the lithium metal oxides of Applicants' amended claims 21 or 22.

The rejection of claims 21 and 22 under 35 USC § 103(a) as purportedly being unpatentable over, Kang et al., US 7,205,072 B2 has been overcome and should be withdrawn.

Claims 4, 9, and 10 stand rejected under 35 U.S.C. 103(a) as purportedly being unpatentable over Shiozaki et al, JP 2002-304993. Claims 4, 9, and 10 all depend upon amended

claim 1 and add further limitations thereto. Since amended claim 1 is patentable over Shiozaki as discussed above, likewise so are claims 4, 9, and 10.

The rejection of claims 4, 9, and 10 under 35 U.S.C. 103(a) as purportedly being unpatentable over Shiozaki et al, JP 2002-304993 has been overcome and should be withdrawn.

### **Request for Rejoinder**

Withdrawn claims 16 and 18-20 incorporate all the claim features of currently amended patentable claim 1. Accordingly, it is submitted that they are likewise patentable. Rejoinder of claims 16 and 18-20 is respectfully requested.

### **Telephonic Interview Summary**

The Applicants wish to thank Examiner Tracy Dove for the telephonic interview that was granted and conducted on February 5, 2009. During the interview, the Applicants discussed the proposed amendment to claim 1 and showed the Examiner support for the amendment and how it should overcome the USC § 112 rejection. The discussion then revolved around arguments relating to the assertion that the amendment of claim 1 also overcomes the USC § 102(b)/103(a) rejections as stated above. Finally, the USC § 103(a) rejections of claims 21 and 22 over Kang were discussed. The Applicant suggested amending claims 21 and 22 as is presented here with a change in the x range so that none of the Figures in Kang are anticipated or suggested by amended claim 21 and 22. During the interview, the Examiner informed the Applicant that since the case was after final rejection that she would not be inclined to enter substantive amendments such as those to claims 21 and 22 that overcome the 103(a) rejection over Kang. The Applicants respectfully request that the Examiner enter all of the amendments since they put all of the claims in condition for allowance. However, it was discussed with the Examiner that if she feels that the amendment to claim 1 is deemed enterable and that it puts the claim in condition for allowance, but the amendments to claims 21 and 22 are not deemed enterable, that the Applicant will suggest that the Examiner enter the amendment to claim 1 and allow claim 1 as well as the claims that depend thereon (claims 2-7, 9-10, 15, and rejoinable claims 16 and 18-20) and cancel claims 21-22 without prejudice.

In view of the above, it is submitted that the application is in condition for allowance.

Examination and reconsideration of the application as amended is requested.

Respectfully submitted,

5-February-2009  
Date

By: /Stephen F. Wolf/  
Stephen F. Wolf, Reg. No.: 45,502  
Telephone No.: 651-736-9485

Office of Intellectual Property Counsel  
3M Innovative Properties Company  
Facsimile No.: 651-736-3833